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A. D. MELVIN, CHIEF OF BUREAU.

EPIZOOTIC CEREBRO-SPINAL MENINGITIS OF HORSES.^a

By R. W. HICKMAN, V. M. D.,
Chief of the Quarantine Division.

DESCRIPTION AND CAUSES OF THE DISEASE.

The disease of horses known as cerebro-spinal meningitis, or staggers, occurs in nearly all parts of the United States, and in certain localities it appears almost every year. It tends to assume an epizootic form in favorable localities during wet seasons, especially such as are characterized by frequent rains alternating with hot sunshine, producing a damp, sultry atmosphere. The latter conditions are most favorable to the production of molds on the various kinds of vegetation upon which animals subsist, and outbreaks of the disease are invariably traceable to unsound or moldy forage or feed or to contaminated water. The disease has likewise been experimentally produced in horses by giving them water to drink which had been previously percolated through moldy silage. Horses at pasture may contract the disease when the growth of grass is such that it mats together, causing the lower part to die and ferment and become moldy, or by drinking from wells or pools containing surface water which is drained through decomposed and moldy vegetation and contains organic matter percolated from these. When the disease appears at times in many horses in the same locality, as in low, flat sections, such as the eastern parts of North Carolina, Virginia, and Maryland and parts of other States where the average elevation of the land is but a few feet above the water level, it is known as epizootic cerebro-spinal meningitis.

In explanation of the word "epizootic" it may be said that it has exactly the same meaning when applied to the diseases of animals that the word "epidemic" has when applied to the diseases of mankind. It is not to be understood as having any reference to or connection with the disease so commonly known as "epizooty," or "the epizootic," a name which has become familiar on account of having been quite generally applied to epizootics of influenza, pink-eye, or the grip. The latter is an infectious specific fever of the

^a Reprinted from the Twenty-third Annual Report of the Bureau of Animal Industry (1906).

horse, ass, and mule of a typhoid nature, having no relation whatever either in cause or character to cerebro-spinal meningitis, or staggers.

No specific bacterium, organism, or virus has been isolated that is capable of demonstration as the causative agent of cerebro-spinal meningitis in the horse. The nature of the affection suggests a narcotic poison introduced from without, rather than a disease due to a germ propagated in the system; and the consensus of opinion among investigators points to the cause of this disease as being associated with molds or parasitic fungi that grow on plants, grains, and other vegetation.

When all the horses of a section are kept under more or less similar conditions and exposed to the same influence at the same time, and that influence happens to be the causative agent of a disease like that under consideration, many of them may become almost simultaneously affected, not as the result of contagion or contact, but as the result of being exposed to the acting cause of such disease at the same time. If this disease happens to be cerebro-spinal meningitis, any success obtainable in its control, the arrest of its progress, and the saving of such animals as are still unaffected or have exhibited evidences of a milder type of the disease must be accomplished chiefly through prophylaxis, or preventive treatment, rather than by means of any medicines that can be administered for its cure. In the light of present knowledge medicines are entirely ineffective in an exceedingly large percentage of cases.

TWO OUTBREAKS IN HYDE COUNTY, N. C.

In the summer of 1901 the writer was assigned to the investigation of a serious outbreak of disease reported, under date of August 22, by Hon. J. H. Small, as existing in Hyde County, N. C., as a result of which it was stated that a large number of horses in the county had either died or were in a dying condition. It would seem proper just at this point to recite in some detail the circumstances connected with this occurrence, by way of illustration.

I proceeded to Bellhaven, N. C., where I was met by Mr. Small, who accompanied me to Scranton, where a practicing physician was in readiness, with a pair of mules and buggy, to take me over the county. The central portion of Hyde County is occupied by a shallow lake, said to have an average depth of but $4\frac{1}{2}$ feet and to be 50 miles in circumference. In contour it forms an irregular ellipse, 7 miles across at the center. In order to go over the county one is obliged to drive completely around the lake, and in following the roads to reach the different farms a distance of about 80 miles must be covered. Immediately after meeting my escort he apologized for his team, stating, "We are all afraid to hitch any of the few horses that have not yet been attacked, as they are being seized and are dying

so rapidly that everybody in the county seems to believe that no horses will be left." He added that no mules had yet been affected. We had not gone very far, however, before it was discovered that this was an error, and that mules, which at first seemed to show some resistance, were being seized with equal facility, and, like the horses, they rapidly succumbed to the disease. The description which he gave me of the trouble, together with what was revealed by the first case visited, led at once to a definite conclusion as to the nature of the disease.

These facts are presented simply with a view to emphasizing the suggestions that will follow in connection with the exceedingly great importance of promptly inaugurating a system of preventive treatment in dealing with this affection, as a disease of such a character and so rapidly fatal leaves but little time or opportunity in a great majority of cases for the action of medicines.

The topography of the country and the situation of Hyde County, N. C.—on tide water—are very favorable for the production of the causes and conditions invariably found to be associated with the occurrence of epizootic cerebro-spinal meningitis of horses. The average elevation of the ground throughout the entire county is said not to exceed $3\frac{1}{2}$ feet. Many of the roads have to be built by chopping down trees, principally cypress, laying them crosswise to the road and covering them with dirt excavated from either side to form ditches for drainage. Cases of the disease are said to occur here every year, but in rainy summers, such as those of 1901 and 1906, when molds luxuriate on plants, grasses, and vegetation, which, with contaminated drinking water from pools and shallow wells, constitute the chief supply of food and drink of many of the animals, the danger of an epizootic outbreak is greatly intensified.

In such cases the losses in horses and mules—the entire dependence of the people in working their farms and in getting about the country—become appalling; hence on this occasion, in their blind efforts to do something to save their desperately sick and suffering beasts, and believing that in such a crisis only the most drastic remedies and radical treatment could be effective, the people proceeded to apply such remedies in a most heroic and vigorous manner. The treatment which I was most frequently informed had been used as I went from place to place, and that which seemed to meet with the most popular favor, consisted in smoking the heads of the sick animals by burning tar and feathers and in the administration of large doses of kerosene and vinegar, which in a number of cases had been poured or injected into the nostrils. Two characteristic symptoms of the disease, namely, the rapid, catching breathing, and the inability to swallow—the latter on account of the paralysis of the muscles of the throat—had evidently suggested to the farmers the

necessity for a vigorous line of treatment to combat disease of the throat and lungs; hence the inhalations of smoke and the administration of supposed remedies through the nose.

In order to secure any degree of success in the treatment of the diseases of our domestic animals it is important that such harsh measures shall be avoided, and that only such remedies be used as may reasonably be expected to assist nature in its efforts to restore a normal state. The physiological action of drugs upon mankind has been learned chiefly through experimentation upon the lower animals, and the indications for their use in the treatment of the diseases of the domestic animals have thus been shown to be practically the same as in the treatment of similar diseases in man when they involve the same organs and anatomical structures of the body. It therefore follows that unnecessarily harsh and radical treatment is to be avoided in both cases with equal care. Except for the fact that cerebro-spinal meningitis is such a fatal malady under the best of medical care and attendance, the great mortality in this outbreak might have been attributed in part to the treatment applied, and the belief seems altogether justifiable that with proper medicines and treatment some of the less acute cases at least might have been saved. As in the case of outbreaks of some other of the serious diseases of live stock, it has been observed that in epizootic cerebro-spinal meningitis those animals which seem to have a considerable degree of resistance and are late in coming down with the disease are more apt to have it in a milder form.

While the remedies which seemed to be indicated were, as far as practicable, prescribed by the writer and administered, the explanation to every one interested, first, as to the source of the disease, and then as to the necessary means of prevention, were given prominence, reference being made to the fact that although in their particular section of country the natural conditions seemed especially favorable, yet in any locality the occurrence of cerebro-spinal meningitis of horses was dependent upon those conditions which are productive of fermentation and the development of molds. As proof of this frequently demonstrated proposition, another equally well-established one was cited, namely, that in those sections of the country in which epizootics of this disease had occurred it had been invariably found that soon after the inauguration of proper hygienic methods of feeding, watering, and sanitation the development of new cases ceased and the disease disappeared.

The following quotation regarding the outbreak of 1906 is made from a letter dated August 1, 1906, received from the physician who drove me over Hyde County in 1901:

I suppose you will be much surprised to hear from me, but we have been having excessively heavy rains which have destroyed practically three-fifths

of all the crops of Hyde County, and now the staggers or some epizootic has struck many of our horses and is killing them very fast in all parts of the county. About 40 horses and mules have died within about three weeks, and the disease is general; almost sure death in all cases, and quite rapid in most cases, from twelve to thirty-six hours; does not seem to favor any; takes some of all kinds, old, young, and middle-aged, fat and poor; the ones that have both good and bad care; some that graze and some that are stall-fed; some that work and others that do not work at all; symptoms about the same as in the epizootic several years ago when you came down here and took a trip with me about the lake investigating the same. We have lost a few horses all along each year, but now everything looks quite gloomy to all of us, for it is quite a hardship on our people. * * * I am quite anxious for you to make us another visit, assuring you that I will either take or send you around the county and assist you all I can in locating the trouble and finding a remedy. We have many new cases to develop almost every day and no remedy. Please give us a little of your time and see if you can help us in any way possible and direct any way that we can get you or some expert here in order to give us some relief.

Letters in the same connection were likewise received by the Department from Representative Small. At the time these letters were received the work of formulating rules to govern the work of the Bureau in conformity with the new meat-inspection law of June 30, 1906, was under way, and as the time for getting the same into operation was close at hand, all of the veterinarians connected with the Bureau work at Washington were pushed to the limit. It was therefore impracticable to comply with these requests, but a circular letter was prepared, giving directions for preventive treatment and the use of such medicines as were considered applicable, and numerous copies were forwarded for distribution among the farmers.

SYMPTOMS.

Following is a brief description of symptoms which it would seem desirable for elucidation to divide into three grades:

1. Those which characterize the most rapidly fatal attacks, in which death takes place within five to forty-eight hours. Such cases are apt to begin with a violent trembling or stupor and extreme weakness, or by actual paralysis, the animals staggering and falling to the ground. Inability to swallow is often a pronounced symptom, the saliva hanging and falling from the lips in strings. There is impairment of vision and usually cramps of the muscles indicated by a rigid contraction, especially of the muscles of the neck, back, and loins, not infrequently causing the head to be drawn back toward the tail. The breathing is usually rapid and catching. The body temperature varies; it is frequently not elevated and may be subnormal, or again it may be up to 104° or 106° F. The pulse is likewise variable during the progress of the disease; it may be almost imperceptible at times, and then again very rapid and irregular. Inability to stand soon

manifests itself and there is delirium, in which the animal lying flat on his side becomes violent, and in his unconsciousness severely knocks and bruises his head, though a deep coma soon renders him quiet until death occurs. In excessively acute cases the animal may fall and die in convulsions.

2. In the second grade of cases some of the symptoms above named, or often a number of them, may be observed, though in a milder form. The first symptoms which usually become manifest are difficulty in swallowing, slowness in mastication, and inability to switch the tail, the animal being unable to offer any resistance if the tail is bent up over the croup. These symptoms may remain with but little change for two or three days, when a gradual improvement may take place, or the reverse may occur. The power to swallow may become entirely lost, stupor or coma may supervene, the pulse become slow and weak, the breathing heavy and noisy, and delirium may develop with spasms and contraction or rigidity of the muscles of the back, neck, and jaws, with a fatal termination in six to ten days.

3. In the third grade, or mildest type of the disease, partial paralysis or loss of perfect control over the limbs, loss of power over the tail, and some difficulty in swallowing are manifested, with some congestion of the mucous membranes of the eyes and nostrils. In other cases there may be paralysis of one or more limbs, but the animal has no fever, pain, or unconscious movements, and may begin about the fourth day to improve and go on to recovery. Not infrequently transverse paralysis (paraplegia), or loss of power of the hind extremities, is a prominent symptom. The absence of coma for one week is a favorable sign, and in such cases with proper care and treatment recovery is usual, though evidences of paralysis may remain for some time. One attack does not protect the animal against a subsequent attack, as horses have been known to have the disease two or three times.

TREATMENT.

First, the animals should be removed to a clean, dry, and airy, or well-ventilated building, and a complete change made in their feed. This is imperative when there is any suggestion of damp, fermentation, or moldiness about the feed; likewise the water must be changed, unless the latter is from a source insuring freedom from pollution. When a considerable area is affected by those conditions which are favorable to fermentation and the production of molds on vegetation, it may be necessary to procure hay, feed, and straw from a distance. Although this may appear an expensive undertaking, it is apt to prove a real economy in the end, as only such grain and forage must be used as are known to be sound and water that is known to be uncontaminated by surface drainage.

Buildings that have been occupied by the horses and mules should be emptied and thoroughly cleaned and disinfected, especial attention being given to drains and low places in stalls, etc. Frequently stables in low sections of the country are built on the level ground, without flooring, and as a result of the stamping of the animals and the removal of litter and bedding the bottoms of the stalls have become sunken below the ground outside, and as a consequence are always wet. The bottoms of such stalls and the entire stable should be kept filled in with dry clay or earth to a higher level than the surrounding ground, and water in such sections should, as far as possible, be provided from driven wells, protected against surface drainage by having the earth slope away in all directions from the pump.

As a disinfectant, liquor cresolis compositus, carbolic acid, or chlorid of lime may be used in 5 per cent solution, made by mixing 6 ounces of liquor cresolis compositus (U. S. P.), carbolic acid, or chlorid of lime with each gallon of water. All floors, drains, etc., should be thoroughly wetted with this solution, and the woodwork of the building then whitewashed with a limewash to which 4 ounces of chlorid of lime or 4 ounces of carbolic acid have been added to each gallon of the whitewash.

MEDICINAL TREATMENT.

In the worst class of cases treatment is not apt to meet with success, as very soon following the onset of the attack convulsions, delirium, or coma supervene, and there is little opportunity for any beneficial effect from the administration of medicines. On account of the inability to swallow, due to a paralysis of the muscles of the throat, attempts to administer medicines are apt to result in a part of the dose, when a drench is forced upon the animal, passing into the windpipe and lungs, and this of itself is a sufficient cause for the production of a fatal pneumonia. It therefore often happens that medicines can only be successfully administered hypodermically. If the animal is seen, however, before inability to swallow becomes a barrier to administering a purgative dose, a ball of aloes may be given. In case of coma or unconsciousness it is possible that a sponge, moistened with ammonia or spirits of hartshorn, carefully held to the nostrils for short intervals, may serve to stimulate and revive the animal sufficiently to admit of the administration of the ball. Further stimulation is also desirable, when practicable, in such cases in the form of alcohol, which should be given in milk to remove its otherwise irritating properties to the throat. Four to 6 ounces of whisky, in 1 to 2 pints of sweet milk, may serve a good purpose, or 2-dram doses of carbonate of ammonia, in the form of a drench, made by dissolving it in 4 ounces of water and adding 4

ounces of molasses, or by pulverizing and mixing the carbonate of ammonia with an equal volume of flour, moistening it sufficiently to make a stiff dough or mass and giving as a ball or bolus, wrapped in a thin tissue-paper covering or inclosed in a gelatin capsule made for the purpose. Physicians are always supplied with hypodermic syringes, and in thinly settled sections, where no veterinarian is available, they might be called upon in such emergencies to administer medicines hypodermically, which in the horse should be injected under the skin on the side of the neck, or under the skin covering the chest or ribs, just back of the elbow.

A purgative is always indicated in the treatment of this disease, and when practicable a ball may be given, consisting of aloes 1 ounce, with which 2 drams of solid extract of belladonna has been incorporated. In the event the animal is unable to swallow, the sole dependence in producing purgation appears to consist in the injection of concentrated medicines under the skin (hypodermically), and these, in fact, when available, frequently answer a much better purpose than medicines given by the mouth, since they are promptly taken up by the blood and are far quicker in their action. A purgative ball or drench given to a horse may not cause purging for twelve to twenty-four hours, whereas a half dram of barium chlorid, injected directly into the juglar vein, or $1\frac{1}{2}$ to 2 grains of eserine, injected under the skin, will usually cause free evacuations of the bowels in fifteen to twenty-five minutes. Other remedies applicable, which would likewise, however, require the services of a veterinarian or physician, either of whom will recognize the indications, are 2-grain doses of strychnia twice or three times a day, which should be discontinued if there is twitching of the muscles of the shoulder or gnashing of the teeth. To stimulate the heart and capillary circulation, when the animal is unable to swallow the drench of whisky or the carbonate of ammonia bolus, quarter-grain doses of atropia may be injected hypodermically every four to six hours, which likewise tends to relieve excitability. Iodid of potassium is also indicated in advanced stages and in convalescence, and may be given in 1 to $1\frac{1}{2}$ dram doses twice daily, to aid in the reabsorption of fluid, this being the suspected cause of the paralytic symptoms, resulting from congestion of the brain and spinal cord and effusion into these organs and their membranes or coverings, which upon post-mortem examination has so often been found to have occurred in fatal cases of this disease.

When evidences of improvement are observable and the animal shows a disposition to eat, give a moderate amount of such good, wholesome feed as he will take, and keep fresh, cold water before him constantly. He should be supported by slings, if at all able to stand with their assistance.